

Broadband Coverage in the Commonwealth of Virginia

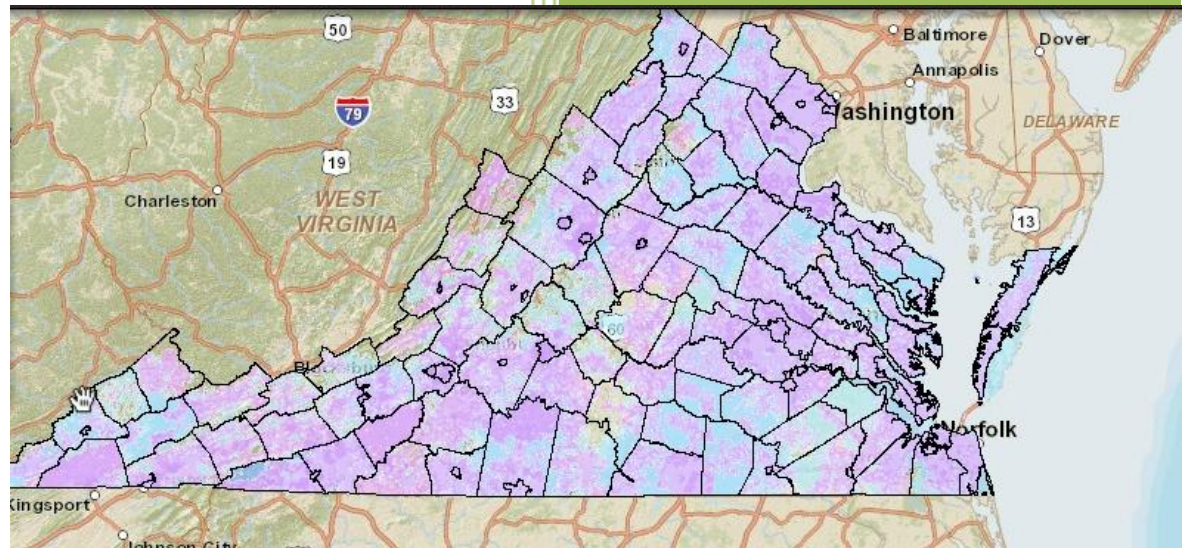


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Executive Summary

The Center for Geospatial Information Technology has performed a spatial analysis to estimate the percentage of the Virginia population falling into certain broadband internet service availability categories. They discovered 89.2% of the population lives in a geographic area with access to fixed-line and mobile broadband coverage.

79.84% of the population claims they have access to the Internet, whether in their home or elsewhere, ranking the state 31st in the United States. This is less than a percentage point lower than the national average of 80.23%. The state was also compared to others in the region, which included Maryland, North Carolina, Kentucky, Tennessee, and West Virginia. Virginia ranked second in the regional rankings measuring claims to Internet access by citizens.

There were 1,161 citizen-reported dead zones, although many of these zones are within areas where service providers claim that there is wired or wireless broadband coverage. The counties with the most reported dead zones are Pittsylvania, Franklin, Bedford, Stafford, Rappahannock, Loudon, and Fauquier. The analysis found that nearly 36% of the geocoded FCC reported dead zones were located in an area that reportedly had wired broadband access. Additionally, when analyzing the FCC reported dead zones against the reported mobile broadband coverage area, over 86% of dead zones are located in an area that is identified as having broadband access.

There are several limitations to the data used in this dead-zone analysis. The FCC-reported dead zones are not all-inclusive, and are simply the dead zones that individuals have taken the effort to report. This is a function of civic engagement, interest, and awareness.

Broadband Coverage in the Commonwealth of Virginia

The Center for Geospatial Information Technology has performed a spatial analysis to estimate the percentage of the Virginia population falling into certain broadband internet service availability categories. The analysis was based on the subset of the fixed-line service provider map data which was provided in the form of census block polygons,¹ as well as the mobile wireless provider data provided in the form of polygons. Year 2010 census block data was used as the source for the population totals. Note that service availability is separate and distinct from the question of actual service subscriptions; this analysis is concerned only with the estimated populations for whom service is available, and does not make any statement regarding the actual number of individuals subscribed to such services.

The analysis does not account for all of the service provider coverage data: not included in this analysis is certain fixed-line service data that was provided in the form of address points and/or road centerlines, as well as stationary wireless service that is available in some regions. Were this data to be included, the total number of people for whom broadband service is available would increase. However, the results derived from the data that is included in this analysis may already be an overestimate of the total population covered, due the generalizations that occur when service providers delineate coverage at a census block level.

Table 1: Percentage of Virginia Population With Broadband Coverage		
Broadband Availability	Estimated Population	% of VA Population
Fixed-line and Mobile Broadband	7,140,251	89.2%
Fixed-line Broadband Only	58,848	0.7%
Mobile Broadband Only	71,4015	8.9%
None of the above	87,910	1.1%
Total VA Population (2010 census)	8,001,024	100%

These broadband categories are exclusive; as such, the total number of people with access to fixed-line broadband is equal to the number of people with "Fixed-line Broadband Only" + "Fixed-line and Mobile Broadband", and the total number of people with access to mobile broadband is equal to the number of people with "Mobile Broadband Only" + "Fixed-line and Mobile Broadband".

¹ Polygons are a geographic information system data structure used to represent areas with common properties. In this case, these areas are the census block, the smallest geographic unit utilized by the Census Bureau.

Table 2: Mobile Broadband Availability (Maximum Advertised Speeds)

Speed Tier	Description	Estimated Population	% of Mobile Broadband Population
3	768 kbps to 1.5 mbps	22,955	0.3%
4	1.5 mbps to 3 mbps	2,536,136	32.3%
5	3 mbps to 6 mbps	7,485	0.1%
6	6 mbps to 10 mbps	146,082	1.9%
7	10 mbps to 25 mbps	5,141,609	65.5%
Total Mobile Broadband Population		7,854,266	100%

There is some uncertainty in these estimates (associated with data quality and timeliness), and this uncertainty has not yet been quantified. It would be misleading to use the estimated population totals for any purpose, because they imply individual-level precision that simply does not exist. Instead of discussing exact populations, it would be preferable to discuss the percent of VA population in each category.

Over the coming months, this analysis may be revised to reflect the other forms of provider data, and this may increase the number of people for whom service is available. In addition, the analysis may be refined to consider other sources of data (reported dead zones, household distribution within census blocks, etc), and this may decrease the estimated number of people for whom service is available.

This analysis was referenced in a policy paper by The Thomas Jefferson Institute for Public Policy entitled “Connecting Virginia: The economic benefits to expanding advanced broadband internet access.” The November 2011 report is available on-line at

<http://www.thomasjeffersoninst.org/files/3/Connecting%20Virginia%20Policy.pdf>

Source and Disclaimer

This analysis is based in part on data provided as part of the National Telecommunications and Information Administration (NTIA) Broadband Mapping Initiative. The Center for Innovative Technology, The Virginia Information Technologies Agency's Virginia Geographic Information Network (VGIN), and Virginia Tech's Center for Geospatial Information Technology are partners on the Virginia portion of this initiative. The following disclaimer applies to the broadband service coverage data collected as part of this initiative:

“The representations contained herein are for informational purposes only. Best efforts are undertaken to ensure the correctness of this information, however, all warranties regarding the accuracy of the map and any representations or inferences derived there from are hereby expressly disclaimed. The Virginia Center for Innovative Technology (CIT) and its partners neither assure nor accept any liability for the accuracy of the data. Those relying upon this information assume the risk of loss

exclusively for any potential inaccuracy. All errors and omissions brought to the attention of the CIT will be promptly corrected.”²

² As displayed in the Virginia Broadband Viewer map at <http://mapping.vita.virginia.gov/broadband/>

Internet Usage Rankings

The Statistical Abstract from the U.S Census Bureau reports information about internet usage on a statewide basis.³ This report shows Virginia's relative ranking to the other states (and the District of Columbia) and the U.S. national average. The Census Bureau reports internet usage on five different categories.

- Percent of Population with Access to Internet Service In-Home or Elsewhere (Dial up & Broadband)
- Percent of Population with Internet Service in Home (Dial up & Broadband)
- Percent of Population with Dial up Internet Service in Home
- Percent of Population with Broadband Internet Service in Home
- Percent of Population with No Access to Internet Service In Home or Elsewhere (Dial up & Broadband)

Additionally, we completed a regional analysis of the same data for the states of Virginia, North Carolina, Tennessee, Kentucky, West Virginia and Maryland.

The results of the national and regional analysis are below.

National Ranking

Percent of Population with Internet Service (Home or Elsewhere)

Virginia ranks 31st with 79.84% of the population claiming access to internet service, whether in their home or elsewhere. This is slightly below the average in the United States of 80.23%. A list of the top 5 states is listed below.

Table 3: Percent of Population with Internet Service (Home or Elsewhere)		
Ranking	State	Percentage
1	Utah	90.10%
2	Alaska	88.64%
3	Washington	88.37%
4	New Hampshire	86.35%
5	Oregon	86.18%
31	Virginia	79.84%
	United States	80.23%

³ See: <http://www.census.gov/compendia/statab/>

Percent of Population with Internet Service in Home (Dial up & Broadband)

Virginia ranks 23rd with 72.99% of the population claiming internet service, either dial up or broadband, in their home. This is above the average in the United States of 71.06%. A list of the top 5 states is listed below.

Table 4: Percent of Population with Internet Service in Home (Dial up or Broadband)

Ranking	State	Percentage
1	Utah	82.31%
2	New Hampshire	80.98%
3	Washington	79.70%
4	Alaska	78.67%
5	Oregon	78.31%
23	Virginia	72.99%
	United States	71.06%

Percent of Population with Dial-Up Internet Service in Home (Lower % is Better)

Virginia ranks 33rd with 3.47% of the population claiming dial up internet service in their home. This is above the average in the United States of 2.82%. For this analysis, a lower percent of population was regarded as better, due to the idea that the fewer people claiming dial up service results in more of the population having broadband internet service. A list of the top 5 states is listed below.

**Table 5: Percent of Population with Dial-Up Internet Service in Home
Lower Percentage is Preferred**

Ranking	State	Percentage
1	Arizona	1.30%
2	Rhode Island	1.33%
3	Wyoming	1.46%
4	New Jersey	1.49%
5	Massachusetts	1.64%
33	Virginia	3.47%
	United States	2.82%

Percent of Population with Broadband Internet Service in Home

Virginia ranks 23rd with 69.51% of the population claiming broadband internet service in their home. This is above the average in the United States of 68.24%. A list of the top 5 states is listed below.

Table 6: Percent of Population with Broadband Internet Service in Home

Ranking	State	Percentage
1	Utah	79.67%
2	New Hampshire	77.82%
3	Washington	76.70%
4	Massachusetts	75.89%
5	Connecticut	74.84%
23	Virginia	69.51%
	United States	68.24%

Percent of Population without Internet Service Anywhere

Virginia ranks 31st with 20.16% of the population claiming that they do not have access to the internet, dial up or broadband, anywhere. This is above the average in the United States of 19.77%. A list of the top 5 states is listed below.

Table 7: Percent of Population without Internet Service Anywhere

Ranking	State	Percentage
1	Utah	9.90%
2	Alaska	11.36%
3	Washington	11.63%
4	New Hampshire	13.65%
5	Oregon	13.82%
31	Virginia	20.16%
	United States	19.77%

Regional Ranking

Percent of Population with Internet Service (Home or Elsewhere)

Virginia ranks 2nd with 79.84% of the population claiming access to internet service, whether in their home or elsewhere. This is above the regional average of 76.12%. The ranking for all the states in the region is listed below.

Table 8: Percent of Population with Internet Service (Home or Elsewhere)

Ranking	State	Percentage
1	Maryland	83.25%
2	Virginia	79.84%
3	North Carolina	76.53%
4	West Virginia	72.87%
5	Tennessee	72.20%

6	Kentucky	72.02%
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Percent of Population with Internet Service in Home (Dial up & Broadband)

Virginia ranks 2nd with 72.99% of the population claiming internet service, either dial up or broadband, in their home. This is above the regional average of 67.91%. The ranking for all the states in the region is listed below.

Table 9: Percent of Population with Internet Service in Home

Ranking	State	Percentage
1	Maryland	76.34%
2	Virginia	72.99%
3	North Carolina	68.42%
4	West Virginia	65.12%
5	Tennessee	63.295%
6	Kentucky	61.275%

Percent of Population with Dial-Up Internet Service in Home (Lower % is Better)

Virginia ranks 3rd with 3.47% of the population claiming dial up internet service in their home. This is below the regional average of 3.72%. For this analysis, a lower percent of population was regarded as better, due to the idea that the fewer people claiming dial up service results in more of the population having broadband internet service. The ranking for all the states in the region is listed below.

**Table 10: Percent of Population with Dial-Up Internet Service in Home
Lower Percentage is Preferred**

Ranking	State	Percentage
1	Maryland	2.23%
2	North Carolina	3.29%
3	Virginia	3.47%
4	Kentucky	3.52%
5	Tennessee	3.80%
6	West Virginia	5.98%

Percent of Population with Broadband Internet Service in Home

Virginia ranks 2nd with 69.51% of the population claiming access to broadband internet service in their home. This is above the regional average of 64.19%. The ranking for all the states in the region is listed below.

Table 11: Percent of Population with Broadband Internet Service in Home

Ranking	State	Percentage
1	Maryland	74.11%
2	Virginia	69.51%
3	North Carolina	65.14%
4	Tennessee	59.49%
5	West Virginia	59.13%

6	Kentucky	57.75%
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Percent of Population without Internet Service Anywhere

Virginia ranks 2nd with 20.16% of the population claiming that they do not have access to the internet, dial up or broadband, anywhere. This is below the average of 23.88% in the region. The ranking for all the states in the region is listed below.

Table 12: Percent of Population Without Internet Service Anywhere

Ranking	State	Percentage
1	Maryland	16.75%
2	Virginia	20.16%
3	North Carolina	23.47%
4	West Virginia	27.13%
5	Tennessee	27.80%
6	Kentucky	27.98%

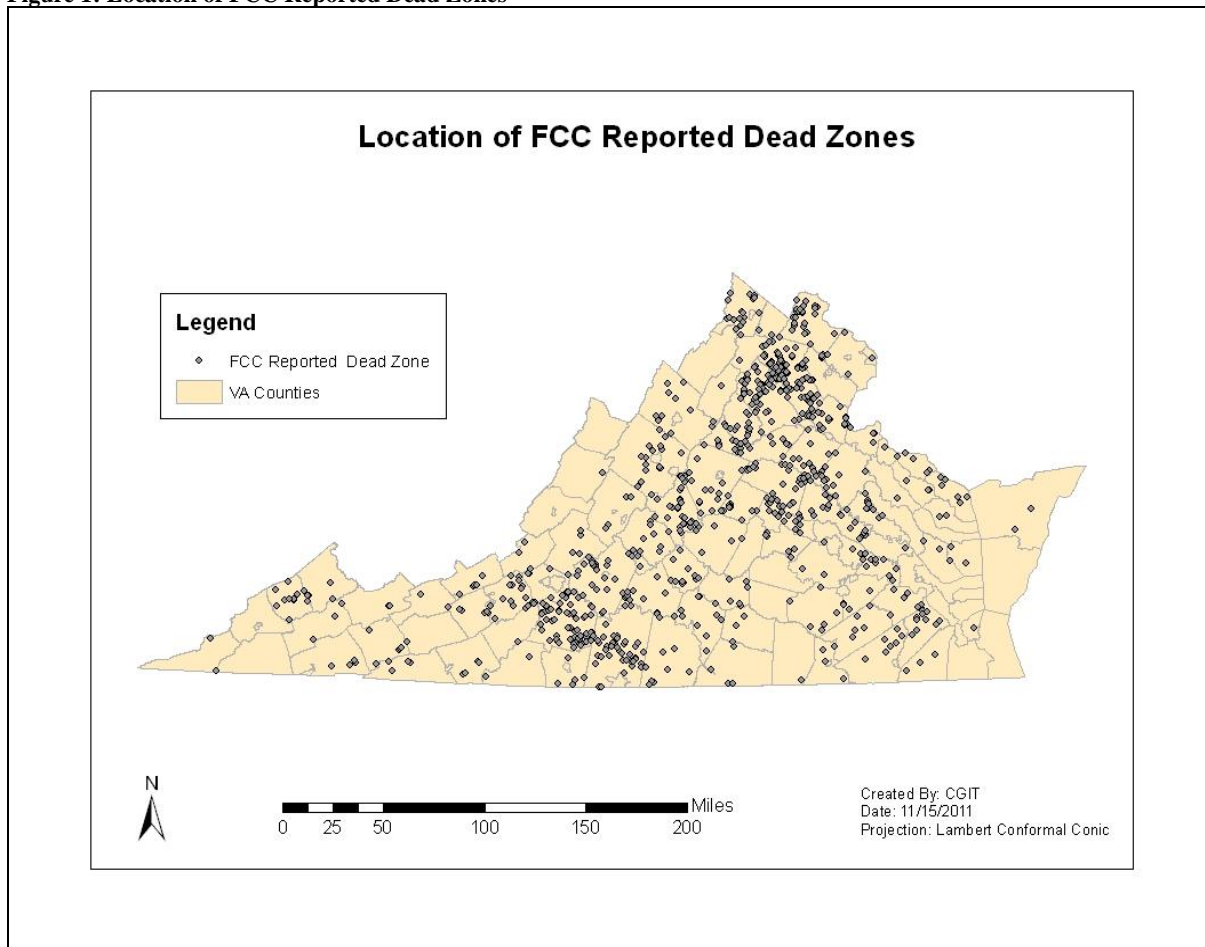
FCC-Reported Dead Zone Analysis for Virginia

This report analyzes the geographic location of the reported dead zones in Virginia, comparing them to several measures of broadband service, as well as locations that have been reported to have broadband access. The analysis presented in this report is based on the dead zone database maintained by the FCC. The FCC created the Dead Zone Registry to allow anyone without access to broadband internet to report their address as a dead zone. The “Broadband Dead Zone Reporting Form” can be completed at www.broadband.gov/qualitytest/deadzone. The FCC describes the Dead Zone Reporting Form as an “opportunity to voluntarily participate in the FCC’s effort to pinpoint areas in the United States where Americans are unserved or underserved by broadband access” (Broadband.gov).

It should be noted that the points identified in this analysis do not necessarily represent a complete list of dead zones within the state, and some may not be true dead zones.

FCC-Reported Dead Zones

Figure 1: Location of FCC Reported Dead Zones



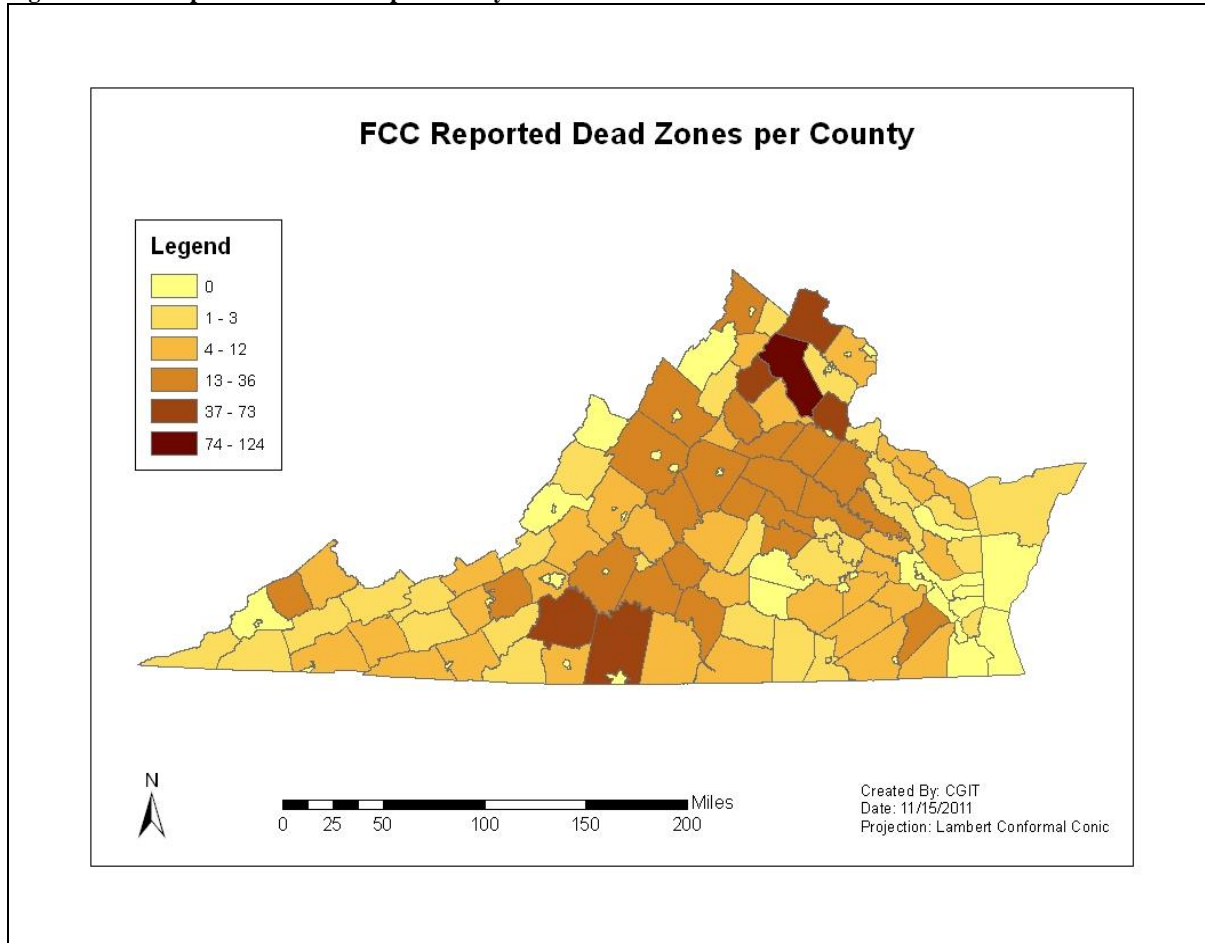
Total Dead Zones Reported	Dead Zones With No ISP	Geocoded Dead Zones	Percent Geocoded (Dead Zones With No ISP)
1,292	1,161	1,077	93%

The map displays the geocoded locations of FCC reported dead zones in Virginia. The above dataset consists of the total number of reported dead zones, minus those reported dead zones that did identify service providers in their area. There were 1292 reported dead zones in the data released on

October 31, 2011. After removing the reported dead zones that listed a service provider in the area, there were 1,161 dead zones that did not identify any service providers in the area. Geocoding the addresses listed in the reported dead zones resulted in 1,077 dead zone addresses matched and displayed on the map.

Dead Zones Per County

Figure 2: FCC Reported Dead Zones per County

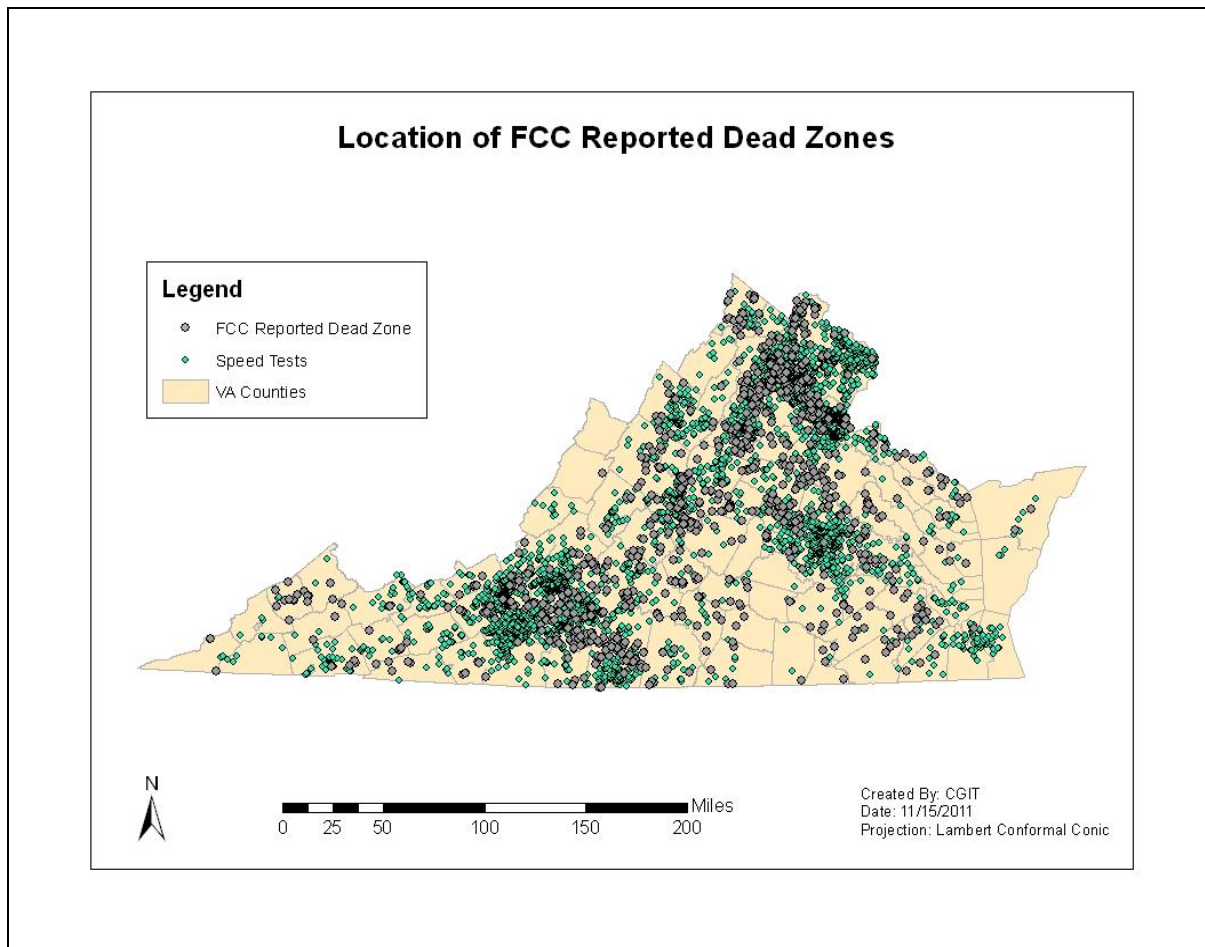


This map represents total number of FCC dead zones reported and geocoded, and is not normalized across population, total number of speed tests, or any other measure. The number of dead zone points per county is a measure of dead zone *reports* received by the FCC, which is determined to some extent by the level of engagement and awareness on the part of the public. The counties with the most reported dead zones are Pittsylvania, Franklin, Bedford, Stafford, Rappahannock, Loudon, and Fauquier.

Note: Accelerate Virginia has partnered with the following counties on speed test programs : Appomattox, Bland, Campbell, Charles City, Charlotte, Floyd, Fauquier, Franklin, Frederick, Goochland, Madison, Montgomery, Nelson, Pittsylvania, Powhatan, Rappahannock, Roanoke, Roanoke City, Rockingham, and Stafford.

Location of FCC-Reported Dead Zones

Figure 3: Location of FCC Reported Dead Zones

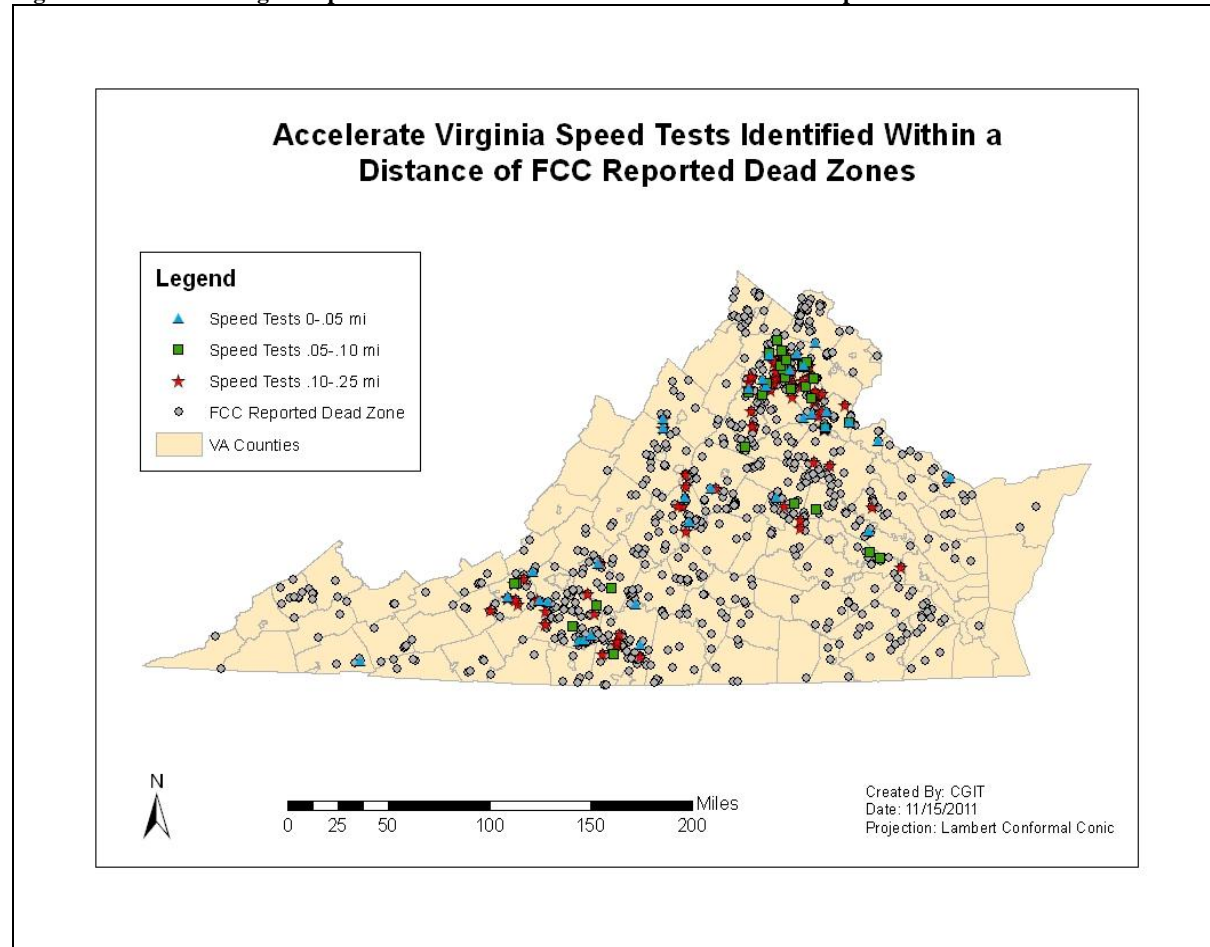


In an attempt to verify the reported dead zones, an analysis was completed to identify any user-initiated speed tests within a specified distance of a reported dead zone. The above map shows the location of all speed tests completed by Accelerate Virginia and the location of the FCC Reported Dead Zones. This is a potential method for validating dead zones due to the assumption that dead zones are less likely to be located near areas that have several reported speed tests. However, as mentioned previously, not all dead zone reports represent a truly “unserved” area; for example, someone may incorrectly report a dead zone due to a lack of knowledge of service or inability to afford internet service.

The map below expands on this analysis to identify the number of speed tests within a predetermined distance of any FCC reported dead zone.

FCC-Reported Dead Zone and Accelerate Virginia Data

Figure 4: Accelerate Virginia Speed Tests Identified Within a Distance of FCC Reported Dead Zones



Distance (mi)	Dead Zones	Total Speed Tests	Number of Speed Tests Identified
0-.05	1,077	5,661	36
.05-.1	1,077	5,661	35
.1-.25	1,077	5,661	103

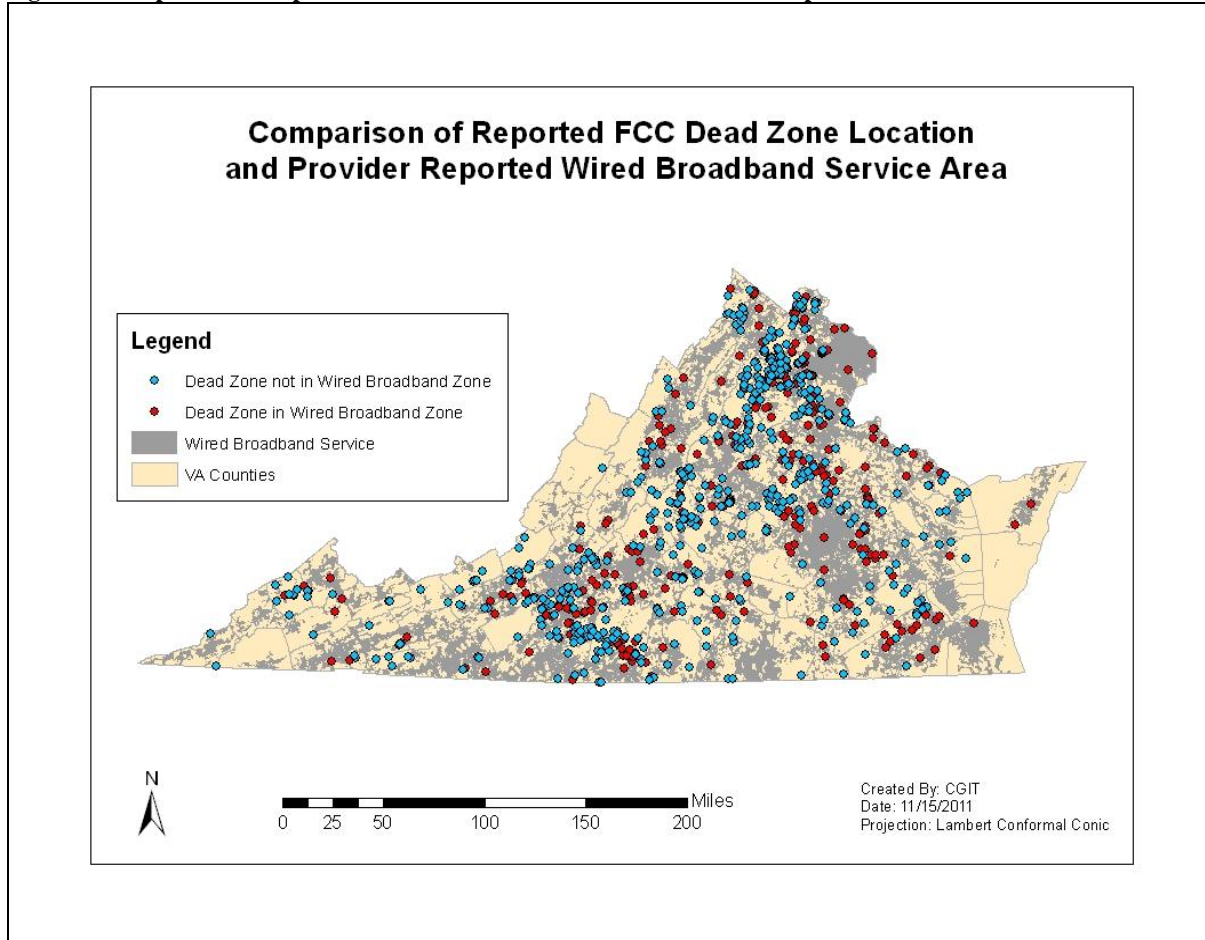
The table shows the results of the analysis. Each distance section is not cumulative. Throughout the state of Virginia we measured 36 speed tests within 1/20th of a mile of a FCC reported dead zone. These FCC reported dead zones could be considered the most uncertain, due to their relative location to reported speed tests. Overall, around 2.5% of total speed tests were within 1/4 mi of a deadzone. However, this does not mean these dead zones should be ruled “untrue,” but should be evaluated further to confirm whether or not it is a “true” dead zone. Because the locations of the dead zone points were obtained by geocoding physical mailing addresses, and the locations of the user-initiated speed tests were indicated by the end-user clicking on a map, there is some imprecision inherent in these locations. As such, very fine-scale comparisons (such as those mentioned above at 1/4 mile and 1/20 mile) cannot be assigned a high degree of

confidence due to the fact that the margin of positional error for both address geocoding and clicking on a web map may exceed these distances.

FCC-Reported Dead Zones and State Broadband Data

Wired Broadband Access

Figure 5: Comparison of Reported FCC Dead Zone Location and Provider Reported Wired Broadband Service Area



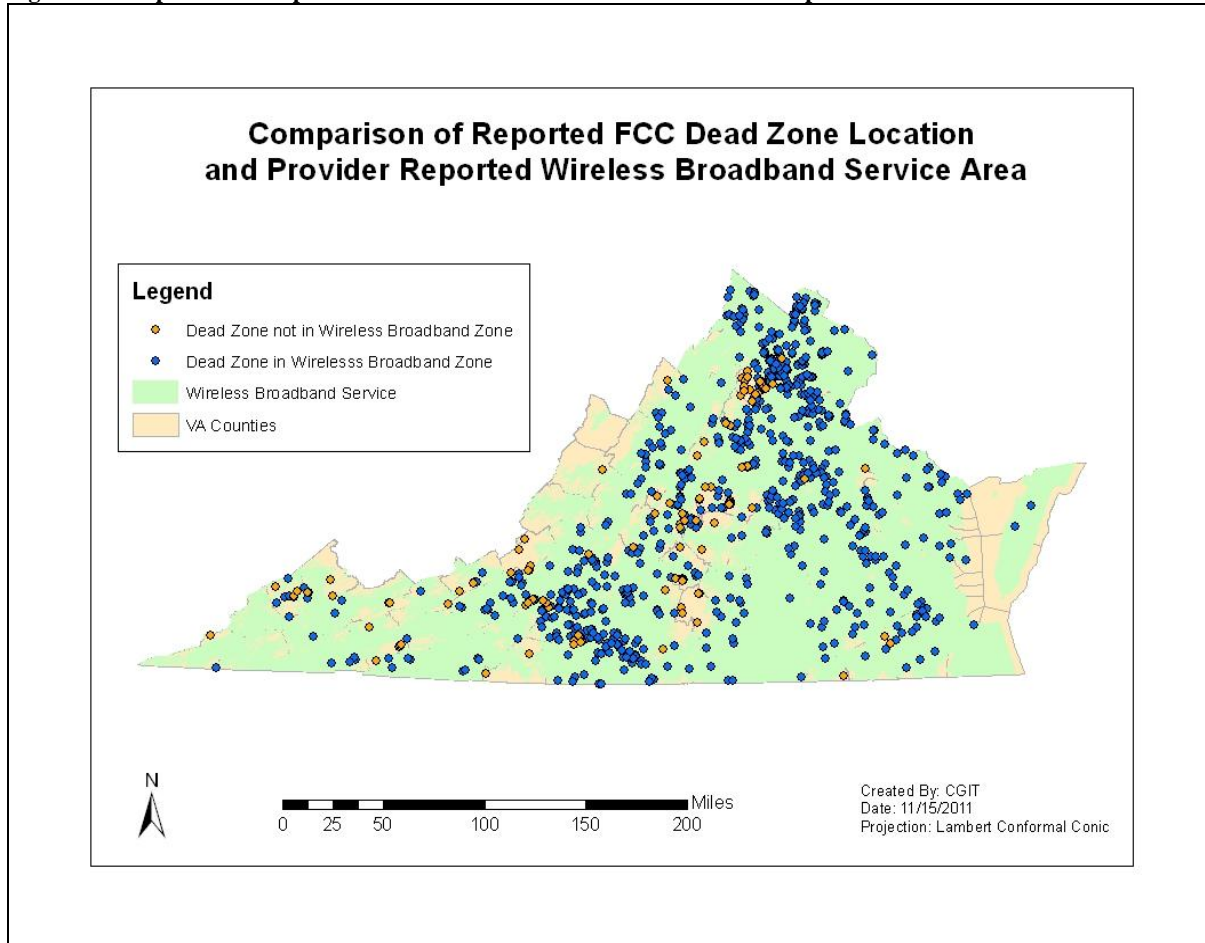
	Dead Zones Inside Reported Wired Broadband Service Area	Dead Zones Outside Reported Wired Broadband Service Area
Total Dead Zones		
1,077	387	690

Recently, Virginia's Statewide Broadband Data Development (SBDD) project team released data identifying which census blocks currently have wired broadband service. This data was intersected with the reported dead zones to locate and distinguish those FCC reported dead zones that are located in an area that is supposed to have wired broadband service from the FCC reported dead zones that are located in areas that do not have wired broadband service. The expectation, if both the FCC reported dead zone locations and wired broadband coverage are correct, is that there would be no overlap between the two. However, that is not the case. This analysis found 35.93% of the FCC reported dead zones in census blocks that were reported to have wired broadband service. This clearly represents an inaccuracy in one of the data sets, either the reported coverage or the FCC reported dead zones. However, 64.07% of the FCC reported dead zones were in a location that was deemed unserved, and thus can be assigned a higher degree of confidence.

There are several possible reasons why such a large percent of FCC reported dead zones fall in areas that are reportedly served by wired broadband. The SBDD data model prescribes that "served" census blocks are those that are, at a minimum, served in one location – however, the entire block need not be served to merit this designation. This may result in an overstatement of the true coverage area. Additionally, the process to geocode FCC reported dead zones may have resulted in a slight error that could inaccurately place the dead zone in an area that is identified as served with wired broadband service. Inaccurate reporting of the original FCC dead zone can also cause a reported dead zone to be located in a wired broadband zone.

Wireless Broadband Data

Figure 6: Comparison of Reported FCC Dead Zone Location and Provider Reported Wireless Broadband Service Area



Similarly, the state broadband map identifies areas of the state which had access to wireless broadband service. This data was intersected with the reported dead zones to locate and identify FCC reported dead zones that are located in an area that is supposed to have wireless broadband service, as well as those FCC reported dead zones that are located in an area that is not reported to have wireless service. This resulted in identifying 86.26% of FCC reported dead zones in an area that is reported to have access to mobile broadband.

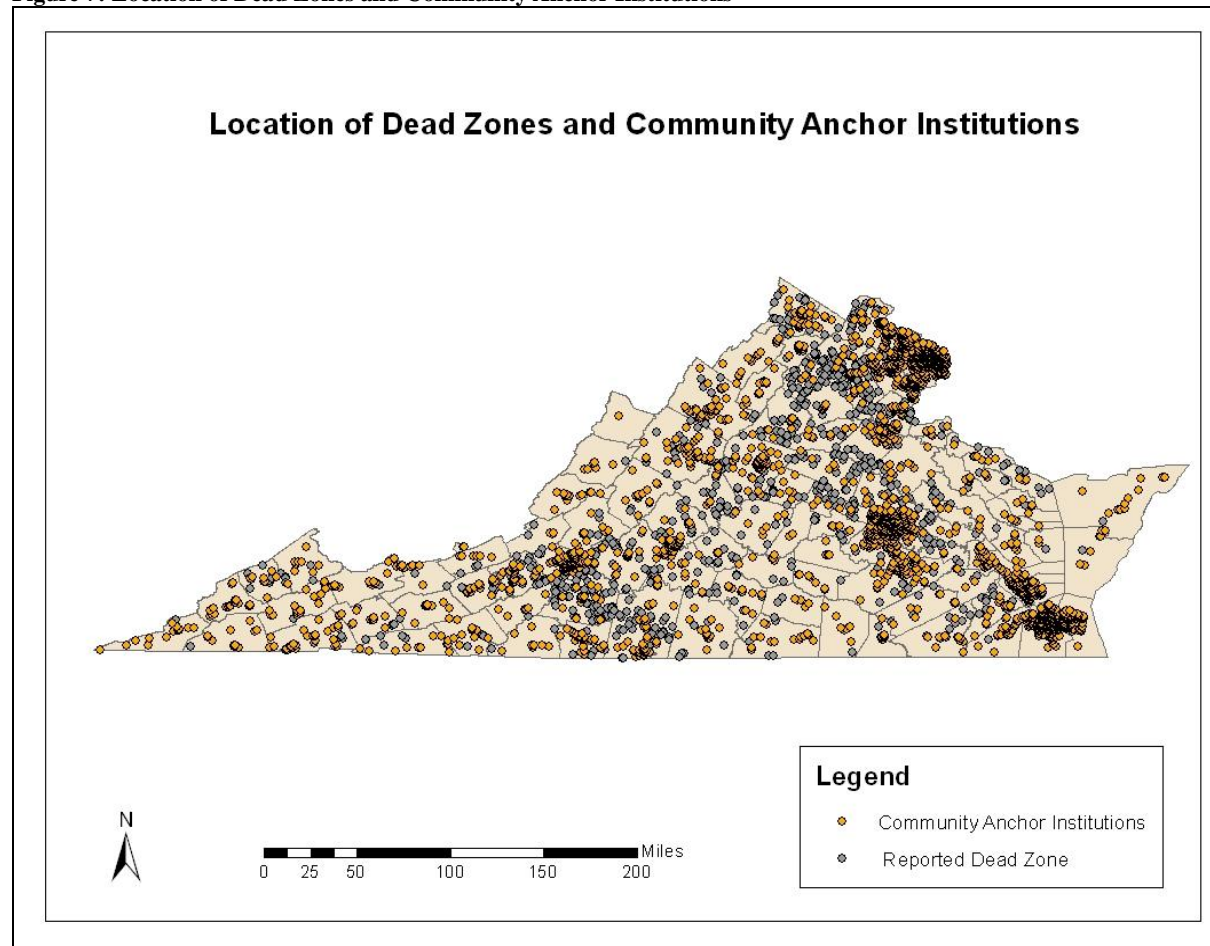
	Dead Zones Inside Reported Wireless Broadband Service Area	Dead Zones Outside Reported Wireless Broadband Service Area
Total Dead Zones		
1,077	929	148

The FCC Broadband Dead Zone registry asks if broadband is available at one's home. The option of mobile wireless broadband may be outside the knowledge or thought process of those

who are reporting the dead zone. These people may simply be thinking of access to traditional wired broadband at their home, not wireless broadband, which is often associated with mobile wireless. Wireless service in general is more pervasive than wired service in its geographic reach in Virginia, so the results in this sense are not surprising.

Community Anchor Institutions

Figure 7: Location of Dead Zones and Community Anchor Institutions



Distance (mi)	Total Dead Zones	Number of Dead Zones Identified	Percent of Dead Zones
0.5	1,077	8	0.74%
Distance (mi)	Total Dead Zones	Number of Dead Zones Identified	Percent of Dead Zones
1	1,077	47	4.36%

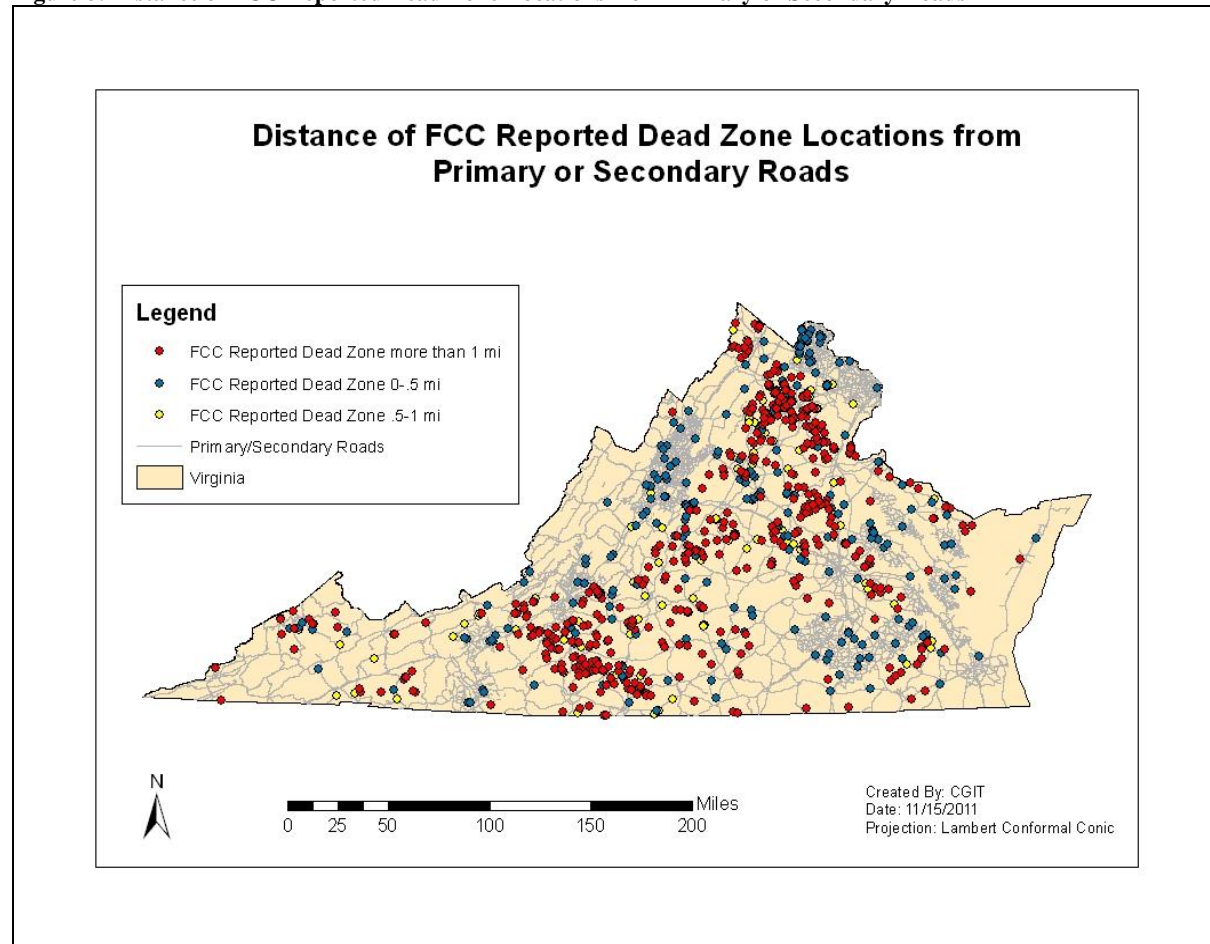
Community anchor institutions are places in the community such as schools, which have access to broadband internet. This map displays the location of community anchor institutions and

reported dead zones. This analysis found that nearly 95% of all FCC reported dead zones were over one mile from the nearest community anchor institution. The analysis was completed using a buffer distance of .5 mi and 1 mi to identify any reported dead zones that were within either distance of a community anchor institution.

It is important to note that there is an inherent imprecision in the geocoding process which may affect the results from measuring distances at fine scales, as described in more detail previously in this document.

Road Infrastructure

Figure 8: Distance of FCC Reported Dead Zone Locations from Primary or Secondary Roads



Distance (mi)	Total Dead Zones	Number of Dead Zones Identified	Percent of Dead Zones
0-0.5	1,077	276	25.63%
Distance (mi)	Total Dead Zones	Number of Dead Zones Identified	Percent of Dead Zones
0.5-1	1,077	133	12.35%
Distance (mi)	Total Dead Zones	Number of Dead Zones Identified	Percent of Dead Zones

> 1	1,077	668	62.02%
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Broadband infrastructure often follows other infrastructure, such as roads. This analysis compares the location of reported dead zones and their distance from the nearest primary or secondary roads as designated by the census. The analysis is the result of measuring distances between primary and secondary roads and geocoded FCC reported dead zones. Distance from roads may be interpreted as a measure of the “remoteness” of a reported dead zone.

Summary and Conclusions

This report has examined the locations of FCC reported dead zones in Virginia and compared them to measures such as data related to broadband coverage, community anchor institutions, and road infrastructure. FCC-reported dead zones are located throughout the state. The counties with the most FCC reported dead zones in Virginia are Fauquier, Pittsylvania, Franklin, Loudon, Stafford, and Rappahannock. As previously noted, this is the result of several factors beyond the actual number of dead zones, including engagement in the process and awareness of the dead zone reporting initiative.

The report also analyzed the location of FCC reported dead zones and found that only 2.5% of all speed tests were located within ¼ mi of a dead zone. This supports the idea that in general, dead zones and speed tests are not typically located in close proximity.

This report compared the location of FCC reported dead zones to reported wired broadband service and wireless broadband service. The analysis found that nearly 36% of the geocoded FCC reported dead zones were located in an area that reportedly had wired broadband access. Additionally, when analyzing the FCC reported dead zones against the reported mobile broadband coverage area, over 86% of dead zones are located in an area that is identified as having broadband access. On the surface it seems this would discredit a majority of the reported dead zones. However, a closer look at the broadband dead zone reporting form simply asks if there is access to broadband internet at one’s home. Mobile wireless is most often associated with wireless broadband, and thus people may not consider wireless broadband an acceptable substitute for having wired or fixed wireless internet access at their home.

The final two analyses looked at the location of FCC reported dead zones in relation to the location of community anchor institutions and primary and secondary roads. The analysis found that around 95% of FCC reported dead zones were more than one mile away from the nearest community anchor institution. Additionally, nearly 2/3 of all dead zones were more than one mile from a primary or secondary road, which supports the theory that broadband infrastructure follows road infrastructure and dead zones are located in more remote areas.

As previously mentioned, there are several limitations to the data used in this analysis. The FCC-reported dead zones are not all-inclusive, and are simply the dead zones that individuals have taken the effort to report. This is a function of civic engagement, interest, and awareness. To place them on a map, the FCC-reported dead zones were geocoded, and there is an inherent positional imprecision within the geocoding process.

Because the NTIA-mandated data model for census-block-level broadband coverage assigns census blocks within Virginia a value of served or unserved based on a minimum threshold of one location within the census block having wired broadband access, it is likely that this dataset presents an overstatement of wired broadband coverage.